

Electronic overspeed detection systems



by Jeff Rudd

Project Applications Engineer
Bently Nevada Corporation
e-mail: jeff.rudd@bently.com

Mechanical versus Electronic Overspeed Systems

Users understand all too clearly the catastrophic results of an overspeed event. Unfortunately, mechanical overspeed protection systems suffer from numerous shortcomings. Even for those mechanical overspeed protection systems that are in perfect working order, two unavoidable aspects of testing these systems render them undesirable: the machine must be removed from its production capacity *and* physically oversped to test the system. In other words, to test your mechanical overspeed protection system, you must stop producing product and put the machine into an unsafe (overspeed) condition.

How serious is this? Consider the following: the insurance industry estimates that fully 50% of catastrophic overspeed events occur when the mechanical overspeed protection system is being tested. With the typical test lasting from a few hours to a full day, the lost production is substantial.

Industry recognizes these issues and has recently begun emphasizing the superiority of Electronic Overspeed Detection Systems (EODS). For exam-

ple, when a user elects to use American Petroleum Institute (API) Standard 612, it mandates that the overspeed system must be electronic, rather than mechanical, and that it use 2-out-of-3 voting. This approach addresses both the safety considerations and the economic considerations. The 2-out-of-3 voting arrangement provides the optimum balance between the probability of a missed trip and the probability of a false trip. The 2-out-of-3 voting also permits you to test the system by electronically simulating an overspeed event in each channel while still leaving the other two channels on-line to protect the machine. Globally-respected standards, such as API 612, are removing the option for mechanical overspeed systems. Instead they are requiring that machines conforming to this standard use only 2-out-of-3 voting electronic systems. The message is clear: an EODS is the new minimum standard for good engineering practices.

3500 – the ideal platform for EODS

For many years, Bently Nevada has been at the forefront of Electronic Overspeed Detection Systems. We're now producing our third generation of such systems. We started with our 7200 Series product (offered only in Europe), then developed our 3300 Series product, and now manufacture our current offering, the 3500/53. With installations worldwide, we've learned what it takes to make a system that is

reliable, that has integrity comparable to other fault-tolerant safety instrumented systems, and that has the conveniences and features users need. In addition, our 3500/53 EODS modules can reside in their own stand-alone rack (as required in API 612) or can reside with other 3500 monitor modules, allowing you maximum flexibility in system design, depending on your philosophy. By using the 3500 System's Communication Gateway module(s), your EODS can be easily integrated with process control systems to give operators instant access to all EODS statuses and values.

Eddy current transducers increase reliability

In all overspeed protection system applications, sound engineering principles must be used when you select speed-sensing transducers. After all, the system is only as good as its input signals. Eddy current proximity probes provide superior performance compared to magnetic pickups. Several of the most significant advantages of eddy current transducers compared to magnetic pickups include:

- Uniform, speed-independent response to zero speed.
- dc gap voltage readings for setting and fault checking.

Gap voltage readings provide information on runout and physical gap, and also enhance transducer and

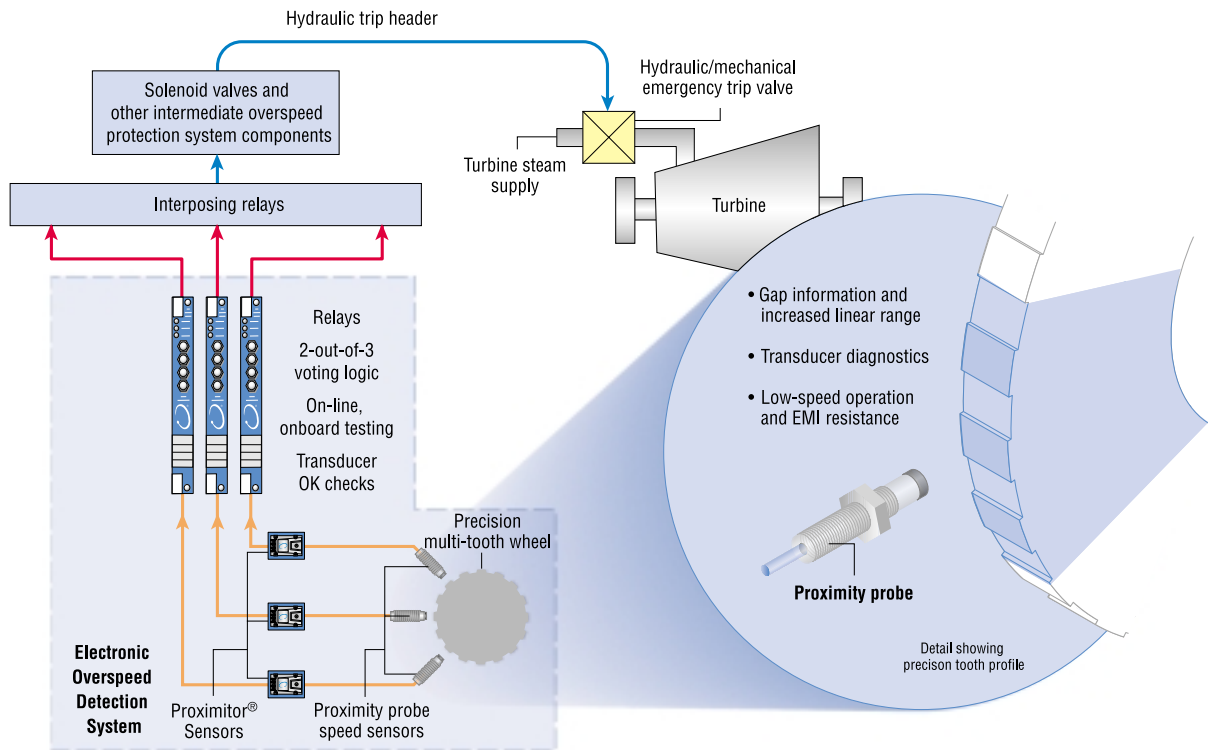


Figure 1. Electronic Overspeed Detection System using a proximity probe transducer system.

wiring fault diagnostics.

- Much longer linear range.

The 80 mil effective linear range of a standard eddy current transducer is far greater than the typical 30 mil nonlinear range of magnetic pickups. This increased range also offers more of a buffer between the sensor tip and the rotating gear teeth. For machines with over 5 mils of mechanical runout or vibration, maintaining proper clearance can be a problem if magnetic pickups are used.

- Greater bandwidth when using longer cable lengths.
- Less susceptibility to EMI (electromagnetic interference).
- Interchangeability with vibration, position, and Keyphasor® transducers, reducing spare part requirements.

Components or solutions?

An electronic overspeed detection system is merely one component in a

complete overspeed protection system. The system must be viewed in its entirety with considerations given to valve response times, steam piping lengths (for steam turbines), process shutdown interlocks, as well as machine trips and rotor acceleration rates. It requires a capable engineering consultant and system integrator, not just a parts vendor.

This extremely critical machinery protection function is often considered a safety-related system by many customers because an overspeed event means not just a process interruption and a broken machine, but a catastrophic failure that can release energy and threaten lives. It is absolutely essential that a qualified system integrator with experience in overspeed protection system design, installation, integration, and testing be used to ensure the system works properly and prevents the machine from ever being able to accelerate beyond maximum permissible

rotational speeds, even during upset conditions, such as a coupling failure. For this reason, it is important to approach an overspeed system as *an engineered system* that requires the services of a skilled engineering consulting firm. Bently Nevada has this skill and experience to provide not just the transducers and protective monitors, but also the installation, engineering, and integration expertise to ensure you get a system that works as intended and is properly designed and installed. We can manage the entire project for you and can even provide services to perform periodic testing of the system as required by your insurer or safety regulations.

For more information, please visit our website – www.bently.com/mktreference.htm – or contact your nearest Bently Nevada sales or service professional. ☺